



Arnold Schwarzenegger
Governor

LIGHTING RESEARCH PROGRAM



Prepared For:
California Energy Commission
Public Interest Energy Research Program

Prepared By:
Architectural Energy Corporation

PIER Summary Report

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PIER Lighting Research Program Project Summaries

ELEMENT 2: ADVANCE LIGHTING TECHNOLOGIES

PROJECT 2.1 LIGHT EMITTING DIODE (LED) LUMINAIRES FOR EXTERIOR, PORCH AND PERIMETER LIGHTING

Project Goals and Objectives

The overall goal of this project is to reduce energy consumption by researching and developing a series of a high performance energy efficient LED based alternatives to incandescent exterior, porch and perimeter lighting in residential, commercial and institutional applications.

The technical goal will include developing a series of 4 to 8 integrated designs with a manufacturing partner that use LED's, advanced controls and optical systems that improve the overall delivery efficacy.

Prototype evaluation will include laboratory testing and field research and application evaluation. Field monitoring protocols will be developed for use by other California groups as needed.

Project Lead: Eric Page and Michael Siminovitch, Lawrence Berkeley National Laboratory

PROJECT 2.2 LED TASK LIGHT UTILIZING NEW MATERIALS TO REDUCE THERMAL STRESS ON HIGH BRIGHTNESS LEDS

Project Goals and Objectives

The goal of this project is to accelerate the use of energy efficient light emitting diodes (LED) technology for general lighting applications by developing a task lamp utilizing high brightness LEDs in a consumer acceptable light fixture, and utilizing new materials that have high thermal conductivity that will enhance lifetime and performance of the LEDs.

Project Lead: Steve Johnson, Lawrence Berkeley National Laboratory

PROJECT 2.3 LED LOW PROFILE FIXTURES

Project Goals and Objectives

The goal of this project is to develop, test, and evaluate prototype, energy-efficient, "low-profile" LED luminaires. These fixtures will be optimized to take advantage of the optical characteristics of LEDs for such applications as task lighting, under-cabinet lighting, shelf, and display lighting.

Project Lead: Nadarajah Narendran, Lighting Research Center

ELEMENT 3: DEMAND RESPONSIVE LIGHTING SYSTEMS

PROJECT 3.1 RETROFIT FLUORESCENT DIMMING WITH INTEGRATED LIGHTING CONTROLS

Project Goals and Objectives

The goal of the project is to develop and test a dimmable, fluorescent lighting system that is suited for easy retrofit into existing commercial buildings and demonstrate the benefits to the lighting community. The system will dim in-line controlled (e.g., "phase-cut") fluorescent dimming ballasts down to 25 percent output and will be controllable by the following manual and automatic means:

1. manual dimming from a wallbox or handheld remote control.
2. automatic lighting control using PC-connected "multi-sensor".
3. manual dimming from PC control panel.
4. utility-triggered load shedding via Intranet-connected PC.
5. IJB "auto-pilot" mode, automatically enabled when PC, multi-sensor or IP connection are not in service.

Combining a dimmable fluorescent lighting system with the above control options will result in an integrated, yet highly flexible lighting control system. This unique lighting solution is particularly suited to retrofit applications since the installation requires no added wiring.

Project Lead: Francis Rubinstein, Lawrence Berkeley National Laboratory

PROJECT 3.2 ENERGY EFFICIENT LOAD SHEDDING TECHNOLOGY

Project Goals and Objectives

The goals of this project are to work with ballast manufacturer partners to develop an instant start load shedding ballast and a simple retrofit load-shed device for fluorescent lighting systems, speed their development, and market introductions. These products will have low cost and dimming range of 30 to 60 percent.

Project Lead: Andy Bierman, Lighting Research Center

PROJECT 3.3 CLASSROOM PHOTOCCELL AND CONTROL SYSTEM

Project Goals and Objectives

The goal of this project is to develop a photosensor and lighting control system that is optimized for common classroom electric lighting solutions (recessed and pendant lighting) and daylighting configurations (side-lighting only, top-lighting only, side- and top-lighting), that can be simply and easily commissioned, and that effectively operates with manual controls and occupancy sensors. The knowledge gained from this process will be public. The Watt Stopper intends to incorporate this public knowledge into a new family of daylighting controls. Other control manufacturers will be in the position to use this information for developing their own devices.

Project Lead: Doug Paton and Dorene Maniccia, The Watt Stopper

ELEMENT 4: ADVANCED LIGHTING LUMINAIRES & SYSTEMS

PROJECT 4.1 HOTEL AND INSTITUTIONAL BATHROOM LIGHTING PROJECT

Project Goals and Objectives

The goal of this project is to develop two energy efficient bathroom lighting technologies that will save energy and improve safety in hotel bathrooms and related institutional applications. The economic goal for the first technology is to achieve 50 to 75 percent energy savings over the estimated base case use and have a three-year payback period. In the second system, the goal is also to achieve 50-75 percent energy savings. The payback as a function of energy in this second system will be longer, but this increased payback will be mitigated by a first cost reduction in installation costs.

Project Lead: Michael Siminovitch, Lawrence Berkeley National Laboratory

PROJECT 4.2 ENERGY STAR RESIDENTIAL FIXTURE PROJECT

Project Goals and Objectives

To organize the higher-end residential fixture manufacturers and co-fund the technical development of 4 to 8 residential ENERGY STAR® table and floor lamp fixtures. An additional goal is to work with the Showroom Lamp companies, ALA, EPA, CEE and other groups to help guide the specifications needed for market acceptance of these new high-efficiency fixtures for the California market. Each fixture would reduce energy use by approximately 75 percent. Using the figure of 20,000 new ENERGY STAR fixtures being sold in the California market in year 1, consumers will save in excess of 2 million kWh per year and approximately one megawatt of electric demand.

Project Lead: Janet Leishman, Applied Proactive Technologies

PROJECT 4.3. DEVELOPMENT OF ENERGY EFFICIENT RETROFIT/REMODEL ALTERNATIVES TO INCANDESCENT DOWNLIGHTS

Project Goals and Objectives

The goal of this project is to develop an energy-efficient retrofit/remodeling downlight system for both residential and commercial applications. The overall costs will approach the costs of the material and labor costs of existing incandescent downlighting systems. By utilizing an integrated systems approach, this system will reduce energy and operating costs by 60-75 percent.

Project Lead: Michael Siminovitch, Lawrence Berkeley National Laboratory

PROJECT 4.4 PORTABLE OFFICE LIGHTING SYSTEMS

Project Goals and Objectives

The goal of this project is to design, develop and prototype portable energy-efficient office luminaires that integrate occupancy-based controls to provide users a higher level of control and visual quality than they currently receive from traditional overhead lighting systems. This system is intended to be flexible enough to be suitable for the varied demands of a broad cross-section of office lighting applications.

On a technical level, this includes developing light distribution systems that integrate user controls with high-efficiency luminaires that provide for both task and ambient lighting needs. The economic goal of

this project is to develop a portable luminaire which, when used as a system, will reduce lighting energy costs by 30-50 percent in conventional office applications.

Project Lead: Michael Siminovitch, Lawrence Berkeley National Laboratory

PROJECT 4.5 INTEGRATED CLASSROOM LIGHTING SYSTEM

Project Goals and Objectives

The goal of this project is to develop a classroom lighting system using a new 97 percent reflective material and integrated controls. This system combines installation flexibility, high-efficiency luminaire with occupancy sensing, daylight sensing, and other classroom and general building controls so that the buyer will have one source for system layout, pricing, training, commissioning, and warranty service.

Project Lead: Terry Clark, Finelite, Inc.

ELEMENT 5 LIGHTING PERFORMANCE, METRICS, CODES AND STANDARDS

PROJECT 5.1 BI-LEVEL STAIRWELL FIXTURE PERFORMANCE

Project Goals and Objectives

The goals of this project are to co-fund the development of bi-level stairwell fixtures with NYSERDA and to determine the energy savings, demand reduction and safety code acceptability of occupancy-based standby lighting in California. The stairwell lights will use built-in ultrasonic occupant sensors to control the lights so that stairwells are lit to full brightness only when the stairwell is occupied. The occupant sensor automatically reduces the lights to a low-power consuming "stand-by" level when the space is unoccupied. Savings are estimated to be up to 75 percent in a typical high-rise commercial buildings depending upon occupancy patterns.

Project Lead: Francis Rubinstein, Lawrence Berkeley National Laboratory and Cylette Willis, International Facility Management Association

PROJECT 5.2 EVALUATIONS OF ELECTRONIC BALLASTS AND RELATED CONTROLS FOR HID LIGHTING SYSTEMS

Project Goals and Objectives

The goals of this project are to:

- Test, analyze and determine the potential of electronic ballasts for high intensity discharge (HID) lighting systems in cooperation with manufacturers as an emerging energy efficient technology to reduce lighting loads in commercial, industrial and municipal applications.
- Identify control strategies to further improve the energy efficiency of these systems with municipal partner.
- Provide appropriate recommendations for incorporating these technologies into current state codes and regulations.

Project Lead: Steve Johnson, Lawrence Berkeley National Laboratory

PROJECT 5.3 LOW GLARE OUTDOOR RETROFIT LUMINAIRE

Project Goals and Objectives

The goals of this project are to:

- Analyze new performance standards developed in Europe for a low glare retrofit system for outdoor luminaires and determine the applicability of this work to U.S. manufacturers of similar luminaires now in use in California.
- Develop design concepts in coordination with a manufacturer for an energy efficient low glare retrofit system for outdoor luminaires founded on results of recent visual performance studies and research data from Europe and North America.
- Develop and demonstrate a prototype retrofit system for outdoor luminaires with manufacturer's participation with improved performance characteristics.

Project Lead: Steve Johnson, Lawrence Berkeley National Laboratory

PROJECT 5.4 DALI LIGHTING CONTROL DEVICE STANDARD DEVELOPMENT

The DALI is a non-proprietary digital communication protocol that allows communications between a DALI ballast and the lighting system. Tridonics, Advance Transformer, and OSRAM SYLVANIA currently offer DALI ballasts. The key features of the DALI ballast enable:

- Two-way communications for obtaining operating status and performance of luminaires.
- Individual fixture control which allows users to re-configure space lighting groups without changing the wiring, easily implement load-shedding functions, and integrate a fixture into multiple control zones.
- The user to mix and match ballasts from multiple suppliers and obtain consistent control operation.
- The elimination of costly installation errors due to reversing control wiring at ballast or control terminals.
- The easy addition of DALI-based wall controls and other devices because a two-wire communications bus is used. This feature greatly reduces labor and installation costs.

Project Goals and Objectives

The goal of this project is to develop an enhanced DALI lighting ballast control standard to allow for the operation and control of a complete lighting system. The enhanced DALI open standard would enable different manufacturers control devices to operate on the same control system. The lighting system includes the ballast, peripheral lighting control devices (such as occupancy sensors, scene switches, centralized network monitoring and photosensors. To realize this goal, industry consensus must be reached among the different control manufacturers. The standard would create predefined messages and commands that would be embedded in the controller intelligence and allow for seamless communication between control devices and between the control device and the ballast.

Project Lead: Dave Peterson, The Watt Stopper

ELEMENT 6: MARKET CONNECTION**PROJECT 6.1 PROGRAM-WIDE MARKET CONNECTION SYSTEM****Project Goals and Objectives**

The goal of this project is to improve the market focus of all the LRP's R&D projects and thereby to increase the ultimate commercial viability of the program's technology products. This is both an economic and a social goal, leading to increased public benefits of PIER's investment in the program's products. The project meets this goal by systematically creating a "commercialization infrastructure" of alliances with key efficiency advocates and regulatory agencies, market-based reviews and refinements of each product's market approach, both professional and consumer audiences, and communications via web and print for more specific aid to products that become ready for commercialization during the program term.

Project Lead: Bob Knight, Bevilaqua-Knight Inc.

PROJECT 6.2 LRP TECHNOLOGY AND PRODUCT DESIGN TOOLS**Project Goals and Objectives**

The goal of this project is to develop new design tools that effectively link the lighting technology and products developed through the PIER LRP to lighting design practice and existing design tools. These design tools will enable quicker application in the marketplace.

Project Lead: Caroline Clevenger, Architectural Energy Corporation

PROJECT 6.3 LIGHTING R&D/CODES SCOPING STUDY**Project Goals and Objectives**

The goal of this project is to determine how the PIER Lighting Research Program can best translate its successes into workable code and standards proposals. The emphasis will be to identify efforts that are likely to have the largest energy savings and/or demand reduction potential.

Project Lead: Doug Mahone, Heschong-Mahone Group



Public Interest Energy Research

The goal of the California Energy Commission's PIER Lighting Research Program (LRP) is to create new lighting technology and products that can save energy, reduce peak demand, and reduce pollution for the citizens of California. The LRP includes fifteen research projects spanning both the residential and commercial sectors as well as outdoor lighting associated with buildings, and three market connection projects.

Lighting Research Program Projects

LED Occupancy Sensor and Bathroom Smart Fixture



Concept: An LED occupancy sensor that can be installed in a half hour or less and serves the dual purpose of lighting control and night lighting for hotel bathrooms. Concept development for a smart bathroom fixture is also planned.

Solution: The Watt Stopper's Motion Sensor Nightlight is the first implementation of this concept. PIER helped fund a demonstration at the Sacramento DoubleTree Hotel with support from the Sacramento Municipal Utility District (SMUD). The resulting data indicated that the nightlight provided 46 percent energy savings. The California Lighting Technology Center (CLTC) is also working with Lithonia and SMUD on development of a bathroom smart fixture. Demonstrations of the fixture in hotel and assisted living applications are underway.

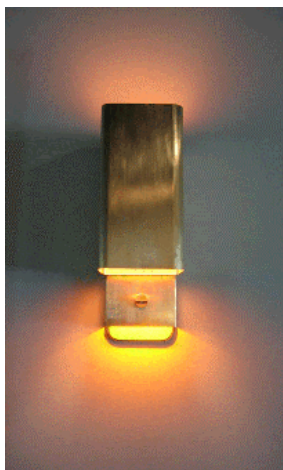
Bi-Level Stairwell Fixture



Concept: A bi-level fixture for stairwells that maintains a low light level, switching to full light output only when occupancy is detected. This product is designed for stairwells, restrooms, laundry rooms, and other areas that demand minimal but constant lighting over long periods of time.

Solution: LaMar Lighting's bi-level stairwell fixture has an integrated occupancy sensor and saves energy by operating most of the time at a low standby light level. Results from four PIER-funded demonstrations, which included three office buildings and a university building in California, indicate energy savings of 40 to 60 percent for stairwell lighting.

LED Exterior Luminaire



Concept: The objective is to work with one or more manufacturing partners to design, prototype, and evaluate a series of exterior porch lighting systems that integrate high efficiency optics with solid state technology and lighting controls into one system.

Solution: The CLTC has developed a series of designs for various exterior applications. The main concept is a hybrid approach to LED illumination. It combines an 'always on' ambient LED illuminator with a standard incandescent lamp on a motion control sensor.

Energy use is reduced from 60 watts for a typical incandescent lamp to 5 watts for the LED package. CFL options may be developed. A demonstration is underway. Three manufacturing partners (Shaper Lighting, The Watt Stopper, and Lithonia Lighting) are working with the CLTC on various fixture concepts.

Retrofit Fluorescent Downlights



Concept: The objective is to develop an easy-to-install compact fluorescent downlight system for use in existing commercial and residential applications.

Solution: Working in close partnership with Lithonia Lighting, the CLTC is developing a simple retrofit strategy for fluorescent downlights with flexible optical head mounting, 2-lamp ballast, low glare reflector optics, and plug-n-play wiring. A new construction version of the product is in production with units currently being installed by a number of Sacramento homebuilders. Energy use of the new construction system is approximately one-third of incandescent. The retrofit product, which will be applicable for residential and commercial installations, is expected to be ready by 2006.

Integrated Classroom Lighting System



Concept: A complete lighting system that simplifies the requisition process for schools trying to meet high energy performance standards by providing direct-indirect fixtures, occupancy and daylight sensors, and plug-and-play interconnection cables.

Solution: PIER's manufacturing partner, Finelite, Inc., coats their direct/indirect fixtures with 96% reflective white paint, allowing for either two or three rows of fixtures. With the Integrated Classroom Lighting System, schools receive premium lighting and controls for less than the cost of standard 2x4 lay-in fixtures. Nineteen demonstration classrooms have shown energy savings of 30 to 50 percent over current Title 24 levels. A secondary project is underway with Southern California Edison (SCE) and The Watt Stopper to develop and recommend a system for the Los Angeles United School District.

ENERGY STAR® Residential Light Fixtures



Concept: Based on data gathered at a series of EPA workshops, PIER is encouraging lighting manufacturers to develop high-end, portable indoor residential fixtures. These fixtures will utilize pin-based CFLs rather than screw-in bulbs, and will qualify for the ENERGY STAR label.

Solution: Four lighting manufacturers — American Fluorescent, Fire & Water, MaxLite, and PowerLux — have developed pin-based CFL portable residential fixtures with electronic ballast that meet ENERGY STAR specifications and provide high-quality lighting. These fixtures will be available in the California marketplace by the end of 2004. Energy savings vary ranging from 50 to 75 percent over a typical 120-watt incandescent fixture.

LED Low Profile Fixtures



Concept: A low-profile LED luminaire that will take advantage of the benefits of solid state lighting. This fixture would be suitable for applications where operating hours are long, space is limited, and reduced maintenance is desired.

Solution: The Lighting Research Center (LRC) has developed prototype fixtures for elevators. A demonstration of the fixture prototype is underway at the Rensselaer Polytechnic Institute campus. Currently, LRC is courting manufacturers to bring the product into production. Preliminary information on jewelry case applications is also under development.

Concept: A high performance task light that uses state-of-the-art LED and thermal management technology.



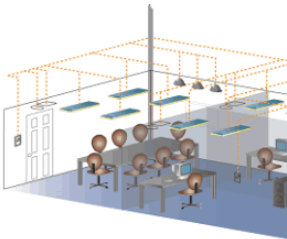
Solution: Lawrence Berkeley National Laboratory (LBNL) has assembled four manufacturers to develop the product. Permlight is prototyping the thermal management assembly board. Advanced Transformer is making the necessary ballast with variable intensity. Cree Lighting is providing the LEDs. Luxo is the luminaire manufacturer, developing designs to meet both the US and European markets. Comparing an 18-watt CFL, the LED task light uses a 10-watt LED package and provides quality optics.

Concept: An improved daylight responsive lighting control for classrooms with an expanded cone of view. The photosensor will be easy to calibrate with a simple hand held tool reusable for multiple installations.



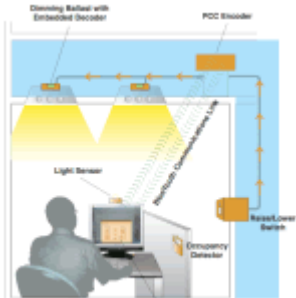
Solution: The Watt Stopper is working to improve their current photosensor design using the PIER-funded performance specification developed through a lengthy process of reviewing existing products, consulting with industry experts, and evaluating computer simulations. The hand held calibration tool simplifies commissioning. A small-scale classroom demonstration at SCE has been completed. Product release is planned for 2005/2006.

Concept: The objective is to develop an open controls standard to allow for a complete DALI-managed lighting system. The enhanced DALI standard will enable the control devices of different manufacturers to operate on the same control system.

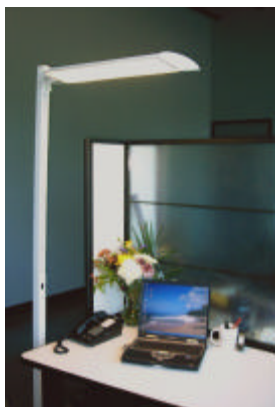


Solution: PIER has brought together a NEMA-facilitated working group of major manufacturers to develop an open standard for controls. This process included gaining input from designer and end-user groups. Some of the participants in the standard development include Advance, Genlyte, Leviton, Lutron, Starfield, Universal Ltd., and The Watt Stopper. A demonstration of the new control standard is underway at two of The Watt Stopper's facilities. NEMA anticipates adopting the standard by 2005.

Concept: An advanced lighting controller designed to bring low-cost control to existing lighting systems in commercial buildings. The specific hardware is designed to work with commercially available fluorescent lighting ballasts to form the core of a highly progressive, functional and efficient lighting control system.



Solution: LBNL researchers collaborated with Vistron to create a proof-of-concept dimmable lighting control system that does not require additional control wiring in the ceiling. The system uses a new power line control communication technology, called Phase Cut Carrier, to send digital commands over existing lighting power circuits. LBNL is communicating with various manufacturing partners about producing the different components of the system.



The Portable Office Lighting System

Concept: A floor-standing fixture with user and space management controls that separately adjusts ambient and task lighting. Optional office-level controls will provide easily choreographed motion/occupancy sensors and monitor usage in a modular way.

Solution: The CLTC and LBNL are currently developing control strategies and prototypes of this system. Finelite, Inc. serves as the manufacturing and commercialization partner. Pacific Gas & Electric (PG&E), SCE, and SMUD have expressed interest in providing demonstration opportunities for the technology. The use of portable office lighting in lieu of overhead systems may reduce energy use up to 60 percent.

Load-shedding Ballast Technology



Concept: The load-shed ballast is designed to replace existing instant start ballasts in fluorescent lighting fixtures used in commercial buildings. When a signal is received via power line carrier communications, the load-shed ballast dims the fluorescent light fixture, reducing the lighting power by a fixed amount during periods of high electric demand.

Solution: The LRC is working with a major ballast manufacturer on integrating the load-shed design into an existing ballast case. In addition, they are surveying power line carrier communication systems to determine the most effective means to deliver the load-shed signal to the ballast. The LRC is also working with NYSERDA to demonstrate the technology in a commercial building in 2005.

Low Glare Outdoor Fixtures



Concept: Wall packs are common on commercial buildings for security and nighttime lighting. The objective is to replace wall packs with a cost competitive product having the following features: high efficiency, quality optical performance, and better light quality. The anticipated results are to reduce energy consumption and night light pollution.

Solution: LBNL is working with Gardco Lighting to model, develop, and evaluate a new concept luminaire, which features a ceramic metal halide lamp and a near full cut-off tilted lens. The Gardco luminaire will throw the light 45 feet when mounted at a height of 15 feet and potentially provide energy savings while illuminating more area than conventional wall packs.

HID Electronic Ballast Testing



Concept: The objectives are to test, analyze, and determine the potential of electronic ballasts for HID lighting systems in cooperation with manufacturers. Control strategies will be studied for commercial, industrial, and municipal applications. Also, appropriate recommendations may be developed for integrating this technology into current state codes.

Solution: The measurements to characterize the performance of HID lamp-ballast systems have been performed at LBNL. Both electrical and spectral performance measurements have been completed for low and high wattage systems. Control strategies are under evaluation. In related work, LBNL is also testing HPS electronic ballasts for the City of Oakland.

Market Connection Activities



Concept: The goals are to provide crosscutting market connection activities for the PIER LRP projects, while improving the market focus of the individual projects to make the products more commercially viable

Solution: Led by Bevilacqua Knight, the PIER team has worked together to create and implement a consistent and coordinated effort of market activities. Expert guidance has been solicited and provided to Project Leaders, and alliances have been developed with key professional, governmental, and trade organizations.

Sensor Placement Optimization Tool



Concept: The goal is to develop software tools that take advantage of the PIER LRP products and technologies or fill a need in the lighting community for a specialized tool.

Solution: The Sensor Placement Optimization Tool (SPOT) is a software package intended to assist a designer in establishing the correct photosensor placement relative to the daylighting and electric lighting. SPOT consists of an Excel interface on top of a Radiance calculation engine that provides information regarding photosensor selection, placement, and performance. SPOT was developed by Architectural Energy Corporation with classroom daylighting in mind, but may be applied to other spaces.

Codes and Standards



Concept: The goal of this project is to determine how the PIER Lighting Research Program can best translate its successes into workable code and standards proposals. The emphasis will be to identify efforts that are likely to have the largest energy savings and demand reduction potential.

Solution: Heschong Mahone Group has been evaluating all the LRP efforts, and mapping the path from each research and product outcome into the codes and standards arena. They have identified the most code-ready technologies and recommended steps to adoption, and identified those projects that may require additional R&D before they can enter the code process.

Detailed information on each of the PIER Lighting Research Program projects is publicly available on the following web sites: <http://www.energy.ca.gov/pier/buildings/projects/500-01-041-0.html> or <http://www.archenergy.com/lrp>.

Arnold Schwarzenegger, Governor
California Energy Commission

Chairman: William J. Keese *Commissioners:* Arthur H. Rosenfeld, James D. Boyd, John L. Geesman, Jackalyne Pfannenstiel



Lighting Research Program



Program Information

April 24, 2003

What Is the Lighting Research Program?



THE LRP IS...

- a two-year \$5.2 million R&D program focused on developing and introducing new energy-efficient lighting technologies into the marketplace.
- a set of diverse projects that includes 15 technical and three market connection projects.
- a unique program sponsored by the California Energy Commission, which engages numerous researchers and manufacturers, and is managed by Architectural Energy Corporation.

What Is the Value of the LRP?



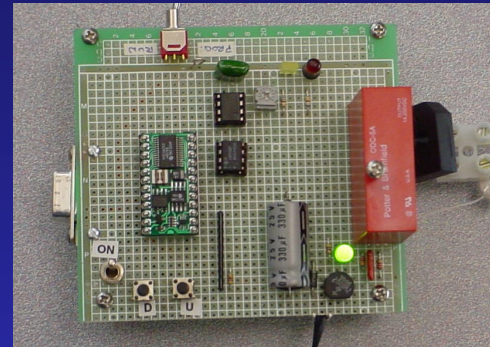
For California citizens, the LRP provides the opportunity to:

- reduce peak electricity demand and energy use.
- integrate research with market connection activities.
- leverage expertise and co-funding from lighting manufacturers.
- minimize pollution throughout California.

Technology Elements of the LRP



***LUMINAIRES
& SYSTEMS***



***DEMAND
RESPONSE***

***ADVANCED
TECHNOLOGIES***



***TESTS &
STANDARDS***



Why Fund a Lighting R&D Program?

LOTS OF REASONS...

- ✓ To address the widespread use of inefficient lighting sources in residential and commercial applications.
- ✓ To focus attention on the successful application and impact of energy-efficient lighting.
- ✓ To encourage coordination and collaboration among researchers and manufacturers.
- ✓ To provide a forum to develop and evaluate technology opportunities.

Various LRP Product Examples

- ➡ LED Display, Cabinet, and Task Lighting
- ➡ Integrated High-Efficiency Classroom Lighting Systems
- ➡ Hotel Bathroom Nightlight with Occupancy Sensor
- ➡ Retrofit Fluorescent Dimming with Integrated Controls
- ➡ Bi-Level Stairwell Fixture with Occupancy Sensor
- ➡ Energy Star Residential Portable Light Fixtures
- ➡ Retrofit Kitchen Energy Efficient Downlights
- ➡ DALI Lighting Control Device Standards

Getting LRP Products to Market

Program-Wide Market Connection Effort

- Specialized consultants
- Technical assistance
- Coordinated activities

- Product Economics and Value
- Product Business Plans
- Alliances with Trade Groups
- Information Materials
- Presentations/Papers
- Manufacturer Involvement
- Demonstration Projects
- Codes & Standards
- Tools for Product Specification

California Energy Commission Connection Overview/Background and Other Research

**IFMA Workshop
March 2, 2004
Chiron Campus, Emeryville, CA**

Donald J. Aumann, PE
CEC Contract Manager
(daumann@energy.state.ca.us 916-654-4588)



■ Overview of PIER Program

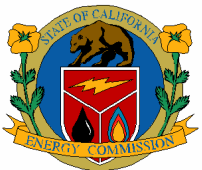
■ Introduction to Other PIER Research

... Lighting

...Productivity

...HVAC

...Lots more!!!



What Is PIER?

- **Public Interest Energy Research**
...Funded by investor owned utility rate payers
- **California electricity industry deregulation legislation in 1996**
- **\$62 million/year program budget**
... Formerly administered by investor-owned utilities
- **Legislative mandates guide program operation and review**



Advance science or technology to achieve public benefits

- Improving energy cost/value
- Improving the environment, public health and safety
- Improving electricity reliability/quality/sufficiency
- Strengthening California economy
- Providing greater choices for California consumers



Six PIER Program Areas

- **Buildings**
(Residential & Non-Residential)
- Industrial/Ag/Water
- Strategic
- Environmentally Preferred Advanced Generation
- Environmental
- Renewables



Selected PIER Hot Topics

Daylighting Impacts on Productivity

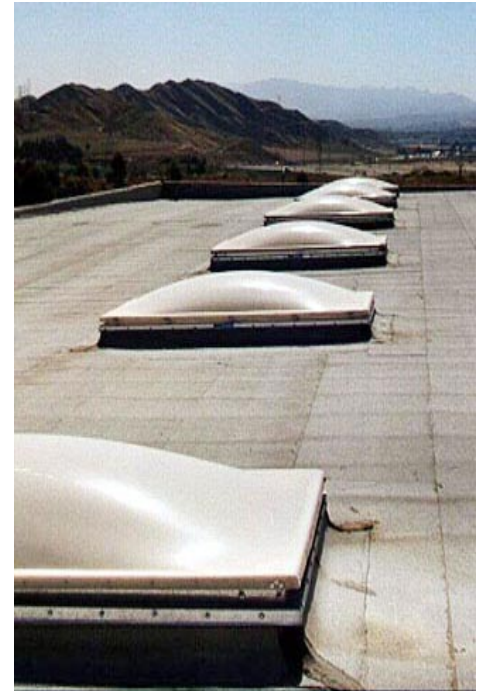
- **Everybody likes daylight**
...Any documented benefits?
- **Recent PIER research results**
...Office worker productivity increases up to 13%
...Ample views associated with better performance
...Window glare reduced performance



Selected PIER Hot Topics

Skylighting—Design Protocol and More

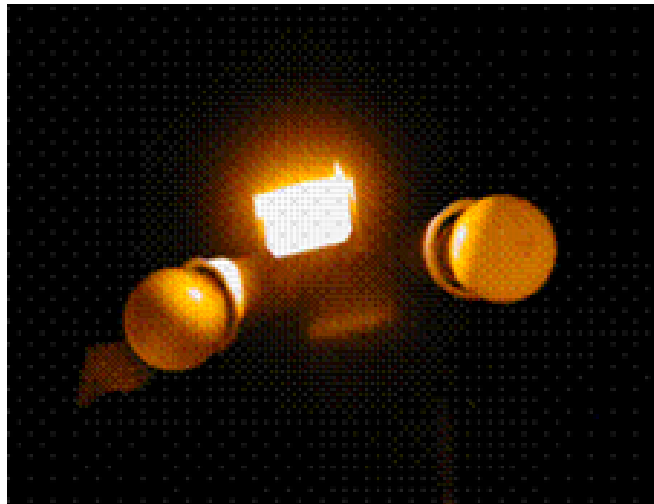
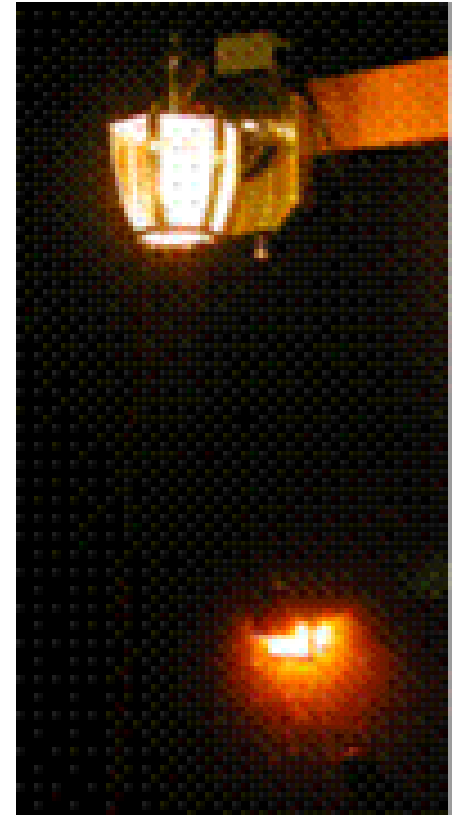
- **Integrated ceiling design guide**
 - ...Avoid custom installations*
 - ...Facilitate communication between ceiling tile manufacturer and skylight manufacturer*
- **New design approach**
 - ...Extensive new testing*
 - ...Treat skylights like light fixtures*



Selected PIER Hot Topics

Outdoor/Entry Lighting

- Integrating LEDs with occupancy sensors
- Two different approaches in prototype development



Selected PIER Hot Topics

Lighting Controls

- **New, optimized, self-commissioning photosensor**
...Wattstopper prototype available soon for schools
...Future office applications
- **Enhanced DALI protocol**
...collaborating w/NEMA
- **Wireless dimming**
..."New" power line carrier and "smart dust"



Selected PIER Hot Topics

HVAC Diagnostics

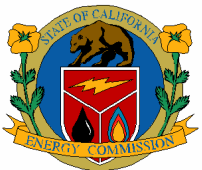
- Automated ID of problems

- Package units

...Commercialization efforts w/Honeywell and FDSI

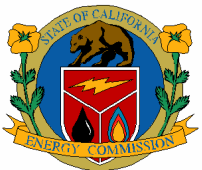
- Air distribution systems

...Commercialization with NIST and BACnet equipment manufacturers



- Thanks for coming!
- Start thinking about ways to leverage PIER resources

**Check www.energy.ca.gov/pier
or additional/new info**





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FOR IMMEDIATE RELEASE
March 22, 2004

Cutting Edge Lighting Research Reaching the Market in 2004

California's publicly funded PIER Lighting Research Program will introduce innovative new energy and cost saving lighting products to California consumers in 2004!

Sacramento, CA – In lighting labs across the country, researchers are hard at work developing and testing new products to improve the efficiency of lighting in California. The Lighting Research Program (LRP), funded in 2002 under the California Energy Commission's Public Interest Energy Research (PIER) Program, supports a broad portfolio of lighting products, including lighting control systems for classrooms and offices, compact fluorescent table lamps and downlights for homes, and a whole class of first generation LED products.

The two-year, \$5.2 million program has brought together researchers from Lawrence Berkeley National Laboratory (LBNL), the Lighting Research Center in New York, and a diverse group of manufacturers from California, New Jersey, New York, and Illinois. The LRP also includes an innovative, centralized approach to market connection, helping researchers and manufacturers integrate knowledge of the California marketplace into their product designs. The program is managed by Architectural Energy Corporation.

"When we first proposed this program, we knew we would be breaking new ground. No other PIER program has previously integrated such a large array of research and manufacturing partners so closely," said Commissioner Art Rosenfeld, presiding member of the Energy

Commission's research and development committee. "A year and a half later it's exciting to see this approach producing valuable results."

Already in 2003, The Watt Stopper of California and LaMar Lighting of New York successfully introduced new products into the marketplace as a result of LRP work. The Watt Stopper's Motion Sensor Nightlight has shown significant energy savings by reducing the number of hours that bathroom lights are left on in hotel rooms. The product uses an LED light to provide sufficient night lighting so hotel occupants can find their way to the bathroom at night. An occupancy sensor turns off the main light whenever the bathroom is not in use. Retrofitting all of California's 350,000 hotel rooms would realize savings of more than 20,000 megawatt-hours per year, or enough energy to power 3,000 average California homes.

LaMar's Occusmart fixture saves energy by reducing stairwell light to code-minimum levels when the stairwells are unoccupied. Besides the energy savings gained from reduced lighting, the bi-level light fixture promotes stairwell safety by providing more light when the stairwells are in use. With the increased sensitivity to issues of safety in stairwells, building owners can increase the total light available to occupants and at the same reduce total energy consumption.

"The Lighting Research Program has helped in the development of our stairwell product for California," says LaMar President Jeff Goldstein. "In addition, with four demonstration sites in the state, we are able to evaluate the performance of our product and make improvements when necessary. With PIER's research we are able to supply the best, most energy efficient product possible."

Finelite, Inc. of Union City, California, has developed an integrated classroom lighting system that combines high-performance T8 lamps, properly tuned electronic ballasts, and reflectors coated with a new 96% reflective paint. The Series 10 PCS (PIER-style Classroom System) has reduced energy use in demonstration classrooms to half of what current regulations allow. If adopted by twenty percent of the schools in California, the new system could save schools over \$20 million a year in electricity costs and conserve 176,000 megawatt hours of electricity per year, equivalent to the power used annually by 26,000 average California homes. The project also includes a "one-stop" warranty and integrated controls to simplify and speed the design process, making it a cost-effective solution for cash-strapped schools looking to lower

construction and operating costs. The system uses direct-indirect luminaires and special audio/video controls that allow a teacher to easily set the classroom lighting for different needs.

Beginning this spring, the first of four brand-new ENERGY STAR® lamps will be available to California homeowners. All of these lamps will use pin-based CFLs. Developed by four different manufacturers—American Fluorescent, Fire & Water, Maxlite, and PowerLux— these lamps will be available from suppliers such as Home Depot and Lowes for hotels, small offices, and homes as alternatives to inefficient torchieres and incandescent table lamps.

In late 2004 Lithonia Lighting will release a fluorescent downlight system developed by LBNL for new home construction and a remodel kit for existing homes. This project will also be available for commercial downlight installations.

Also, in the commercial and institutional market, LBNL is developing a hybrid exterior luminaire that combines an LED array for ambient light and a traditional incandescent lamp triggered by a motion sensor to provide full illumination. This hybrid luminaire encourages safety at a lower cost than comparable solutions that include only a motion sensor.

Products developed in the PIER Lighting Research Program will be featured at the Lightfair International Conference and the Hospitality Design Expo, both in Las Vegas. In June, products will be featured at the West Coast Energy Management Congress in Anaheim and in August, LRP products will also be featured in a product showcase and a number of presentations at the Alliance for an Energy-Efficient Economy's (ACEEE) 2004 Summer Study.

In addition to product development, the LRP also funds applied research focused on the successful adoption of energy-saving technologies. This research includes measuring the performance of new HID electronic ballasts to help develop advanced controls strategies, supporting the establishment of industry standards for the DALI communication protocol, and developing and testing load-shedding technologies.

* * *

Detailed information on the specifications guiding each of these projects is publicly available through PIER's Lighting Research Program. Visit the Lighting Research Program's web site at www.archenergy.com/lrp. For information about the PIER program, please visit the California Energy Commission web site at www.energy.ca.gov/pier. You can also contact Bret Logue at BKi, 510-444-8707 x 209 or Percy Della at the California Energy Commission, 916-654-5027.

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SMUD News Release

Sacramento Municipal Utility District • News Media Services • 916•732•5111

For Immediate Release: March 14, 2003

Sacramento DoubleTree Hotel gets Energy-Efficient Lighting Control System

New demonstration project based on new Berkeley Lab research

A Sacramento DoubleTree Hotel could see energy savings of 15 to 20 percent based on the recent development and installation of a new lighting control system. The pilot project, developed as a partnership with the Berkeley Lab (Lab), DoubleTree Hotels, WattStopper, Inc. the California Energy Commission, and the Sacramento Municipal Utility District (SMUD) involves the installation of the new lighting controls in all 400 of the hotel's guest rooms. The results will be carefully studied over a nine-month time period by Lab researchers.

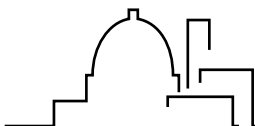
The demonstration project grew from a study to search for ways of improving energy efficiency in the hospitality industry. "The study found that one of the largest energy-saving opportunities in hotel guestroom lighting is the elimination of the extended operation of bathroom fixtures," said Lab lighting researcher Michael Siminovich. "It was found that more than 75 percent of the energy used by these fixtures occurs when bathroom fixtures are left on for more than two hours at a time and most often during the overnight hours."

Researchers determined that the standard solution of installing traditional occupancy sensors that automatically turn out the lights when a guest leaves the room could reduce the comfort level for guests. However, researchers found that sensors with longer set times (one hour or more), could still provide significant energy savings. WattStopper, Inc., a manufacturer of automatic lighting, heating, ventilation, air conditioning and office power control products, developed a sensor based on the Lab's research that would capture energy savings without compromising guest comfort or sacrificing lighting quality.

The newly developed sensor replaces the standard wall switch. It is set to automatically turn off the bathroom lights after one hour. After the lights turn off, an energy-efficient light-emitting diode nightlight turns on providing illumination. The nightlight replaces the need for guests to keep inefficient bathroom lights on throughout the night.

SMUD approached its customer the DoubleTree Hotel to assist with the demonstration project. "It's customers like the DoubleTree Hotel who make the Customer Advanced Technologies program a success," said SMUD Program Manager Dave Bisbee. "They are known for looking at new ways to save energy and improve

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SMUD News Release

Sacramento Municipal Utility District • News Media Services • 916•732•5111

2-2-2-2 Sacramento DoubleTree Hotel gets Energy-Efficient Lighting Control System

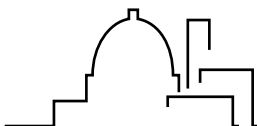
comfort for their guests.”

The Department of Energy’s Office of Building Technologies division funded the research project. WattStopper, Inc. developed the pilot sensor with the help of the California Energy Commission’s Public Interest Energy Research project. DoubleTree Hotels and SMUD will share product and installation costs.

SMUD provided funding under the Customer Advanced Technologies (C.A.T.) program. The program works with SMUD customers to encourage the use and evaluation of new and underutilized technologies.

To learn more about SMUD’s C.A.T. program, visit <http://www.smud.org/community/cat/>

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For Immediate Release

Union City, CA – August 2003

Finelite and the California Energy Commission's Public Interest Energy Research Project (PIER) have developed a cost-effective Integrated Classroom Lighting System that improves lighting quality, provides more teacher control, delivers energy savings of 30-50% and installs at the same cost as current layouts.

The heart of the system is two-rows of a high-quality direct/indirect luminaire that is recommended by the American National Standards Institute (ANSI), the Illuminating Engineering Society of North America (IESNA), and the Collaborative for High Performance Schools (CHPS). The system uses new, 96% reflective materials together with Super T8 lamps and electronic ballasts to provide excellent general classroom lighting at under 1 watt / square foot.

The performance and quality of lighting is so superior that the luminaire layout can be designed to maximize energy savings and still maintain recommended lighting practices. Plug-and-play components together with factory calibration and pre-approved templates help ensure low installation costs. "Ensuring that this outstanding system can be installed within today's tight budgets is a critical project objective," says Terry Clark, President of Union City, CA based Finelite, Inc. Options include dimming, daylight control, occupancy control, and retrofit-compatible, low-voltage control wiring. This means that each school can tailor the integrated classroom system to meet its unique requirements.

The system incorporates an innovative Teacher Control Center that lets the teacher change the lighting from the front of the classroom. The teacher can select an "up-light" mode that creates well-lighted walls with glare-free illumination. Alternately, the teacher can select the "down-light" mode that focuses the light downward and reduces wall brightness and reflections. This mode is ideal for reading periods and note taking during audio video presentations. The optional dimming system is also controlled from this center.

The Integrated Classroom Lighting System has been installed in 19 test classrooms throughout California. The project will monitor energy consumption and usage patterns in each of these classrooms for the 2003 – 2004 teaching year. Independent researchers have documented overall light levels and teacher preference. The system is in production and design support is available.

To learn more about this system and its components, visit www.energy.ca.gov/PIER, www.archenergy.com/lrp and www.Finelite.com.